

CLAIMS

What is claimed is:

- 5 1. In a network region having a plurality of links, each link including a plurality of nodes, one of the nodes of each link serving as a specified router responsible for certain communications in the network region on behalf of the link, a method for configuring the nodes with network-layer addresses, comprising:
- 10 for each node of each link, assigning a group-wise unique node number to a first field of the network-layer address of the node; and
- at the specified router of each of the links:
- 15 (i) receiving messages from the specified routers of the other links, the message from each specified router containing a number selected to be used as a region-wise unique link number for the associated link, and storing the received numbers in association with the respective
- 20 links in a local database;
- (ii) selecting a number to be used as a region-wise unique link number for the link in a second field of the network layer addresses of the nodes on the link, the selected number being a number not associated with another
- 25 link in the local database; and
- (iii) generating a message containing the selected number and propagating the message within the network region for receipt by the other specified routers.
- 30 2. A method according to claim 1, further comprising at the specified router for each of the links:
- monitoring the messages received from the other specified routers to determine if another specified router has selected the selected number for use as a region-wise unique link number;

upon determining that another specified router has selected the selected number, evaluating a conflict-resolution criterion to determine whether the other specified router is entitled to keep the selected number for such use; and

5 upon determining that the other specified router is entitled to keep the selected number, repeating the selecting and generating for a different number.

10 3. A method according to claim 1, further comprising assigning a region number to a third field of the network-layer addresses of the nodes in the network region.

15 4. A method according to claim 1, wherein the specified routers participate in a link-state routing protocol within the network region, and wherein the messages are link-state packets.

20 5. A method according to claim 1, wherein each message includes a link name operative to uniquely identify the associated link in the network region.

25 6. A method according to claim 5, wherein the link name included in each message includes a link-layer address of the specified router for the associated link.

30 7. A method according to claim 6, wherein the link-layer address is a globally-unique media access control address.

8. A method according to claim 5, wherein the link name in each message further includes a port number identifying a port of the specified router to which the associated link is connected.

9. A method according to claim 1, wherein the specified router for each link is a selected one of one or more routers on the link.

10. A method according to claim 9, wherein for each link the routers engage in a distributed selection process by which the specified router is selected.

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11. In a network region having a plurality of links, each link including a plurality of nodes, one of the nodes of each link serving as a specified router responsible for certain communications in the network region on behalf of the link, a method for configuring the nodes with network-layer addresses, comprising:

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for each node of each link, assigning a link-wise unique node number to a first field of the network-layer address of the node;

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at the specified router for each of the links, generating a request message identifying the associated link uniquely within the network region, and propagating the request message within the network region;

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at an address-assigning node in the network region, (i) receiving the request messages from the specified routers of the links, (ii) assigning a region-wise unique link number to each link for which a request message has been received, (iii) generating link number assignment messages containing the assigned link numbers, and (iv) propagating the link number assignment messages to the specified routers; and

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at the specified router of each link, receiving one of the link number assignment messages propagated by the address-assigning node and assigning the link number from the received link number assignment message to a second field of the network-layer addresses of the nodes of the link.

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12. A method according to claim 11, further comprising assigning a region number to a third field of the network-layer addresses of the nodes in the network region.

13. A method according to claim 11, wherein the specified routers participate in a link-state routing protocol within the network region, and wherein the request messages are link-state packets.

14. A method according to claim 11, wherein each request message includes a link name operative to uniquely identify the associated link in the network region.

15. A method according to claim 14, wherein the link name included in each request message includes a link-layer address of the specified router for the associated link.

16. A method according to claim 15, wherein the link-layer address is a globally-unique media access address.

17. A method according to claim 15, wherein the link name in each request message further includes a port number identifying a port of the specified router to which the associated link is connected.

18. A method according to claim 11, wherein the specified router for each link is a selected one of one or more routers on the link.

19. A method according to claim 18, wherein for each link the routers engage in a distributed selection process by which the specified router is selected.

20. A method according to claim 11, wherein the address-assigning node is a selected one of the specified routers in the network region.

21. A method according to claim 20, wherein the specified routers engage in a distributed selection process by which the address-assigning node is selected.

5 22. A method according to claim 11, wherein the address-assigning node is operative to maintain a local database containing a plurality of entries, each entry associating a link number with a link to which the link number has been assigned, and wherein the address-assigning node is operative to assign a
10 link number to a link only if the link number is not already assigned to another link as reflected in the entries of the local database.

15 23. A method according to claim 22, wherein each request message received by the address-assigning node contains a current link number assigned to the associated link, and wherein the address-assigning node is operative for each received request message to:

20 re-assign the current link number to the associated link if such an assignment does not conflict with any other link number assignments as reflected in the local database; and

upon such re-assignment, add an entry for the re-assigned link number and associated link to the local database if such an entry is not already contained therein.

25 24. A method according to claim 11, wherein each request message includes (i) a current link name currently uniquely identifying the associated link in the network region, the current link name including a link-layer address of the current specified router
30 for the associated link, and (ii) a previous link name, if existing, previously uniquely identifying the associated link in the network region, the previous link name including a link-layer address of a previous specified router for the associated link, and wherein the address-assigning node is

operative for each received request message to determine whether a link number is already assigned to the link identified by the previous link name, and if so to re-assign the link number to the same link and associate the link number with the current link name.

25. A system for configuring nodes of a network region with network-layer addresses, the network region having a plurality of links, each link including a plurality of the nodes, the system comprising a plurality of specified routers each associated with a corresponding one of the links, the specified router associated for each link being operative to:

(i) continually receive messages from the specified routers of the other links, the message from each specified router containing a number selected to be used as a region-wise unique link number for the link, and store the received numbers in association with the respective links in a local database;

(ii) select a number to be used as a region-wise unique link number for the link in a second field of the network layer addresses of the nodes on the link, the selected number being a number not associated with another link in the local database; and

(iii) generate a message containing the selected number and propagate the message within the network region for receipt by the other specified routers.

26. A system for configuring nodes of a network region with network-layer addresses, the network region having a plurality of links, each link including a plurality of the nodes, comprising:

a plurality of specified routers each associated with a corresponding one of the links, the specified router associated with each link being operative to (i) generate a request message identifying the associated link uniquely within the network

region, and (ii) propagate the request message within the network region; and

an address-assigning node in the network region, the address-assigning node being operative to (i) receive the request messages from the specified routers of the links, (ii) generate link number assignment messages containing the assigned link numbers, and (iii) propagate the link number assignment messages to the specified routers;

the specified router of each link being further operative to (i) receive one of the link number assignment messages propagated by the address-assigning node, and (ii) assign the link number from the received link number assignment message to a field of the network-layer addresses of the nodes of the link.

27. In a network region having a plurality of links, each link including a plurality of nodes, one of the nodes of each link serving as a specified router responsible for certain communications in the network region on behalf of the link, a method of operating the specified router associated with one of the links to configure the nodes of the link with network-layer addresses, comprising:

(i) receiving messages from the specified routers of the other links, the message from each specified router containing a number selected to be used as a region-wise unique link number for the link, and storing the received numbers in association with the respective links in a local database;

(ii) selecting a number to be used as a region-wise unique link number for the link, the selected number being a number not associated with another link in the local database; and

(iii) generating a message containing the selected number and propagating the message within the network region for receipt by the other specified routers.

28. In a network region having a plurality of links, each link including a plurality of nodes, one of the nodes of each link serving as a specified router responsible for certain communications in the network region on behalf of the link, a method of operating the specified router associated with one of the links to configure the nodes of the link with network-layer addresses, comprising:

generating a message identifying the link uniquely within the network region, and sending the request message to an address-assigning node in the network region; and

receiving a link number assignment message from the address-assigning node, the link number assignment message containing a region-wise unique link number generated by the address-assigning node for the link, and assigning the link number from the received link number assignment message to a link number field of the network-layer addresses of the nodes of the link.

29. In a network region having a plurality of links, each link including a plurality of nodes, one of the nodes of each link serving as a specified router responsible for certain communications in the network region on behalf of the link, a method of operating an address-assigning node to configure each node in the network region with a link number portion of a network-layer address of the link, comprising:

receiving messages from the specified routers of the links, each message identifying the associated link uniquely within the network region;

assigning a region-wise unique link number to each link for which a request message has been received; and

generating link number assignment messages and sending them to the specified routers, the link number assignment message sent to each specified router containing the link number assigned to the associated link.

30. A computer program product including a computer readable medium, the computer readable medium having an address configuration program stored thereon for execution in a computer functioning as a specified router for a link in a network region, the address configuration program comprising:

(i) program code for receiving messages from the specified routers of the other links, the message from each specified router containing a number selected to be used as a region-wise unique link number for the link, and for storing the received numbers in association with the respective links in a local database;

(ii) program code for selecting a number to be used as a region-wise unique link number for the link, the selected number being a number not associated with another link in the local database; and

(iii) program code for generating a message containing the selected number and propagating the message within the network region for receipt by the other specified routers.

31. A computer program product including a computer readable medium, the computer readable medium having an address configuration program stored thereon for execution in a computer functioning as a specified router for a link in a network region, the address configuration program comprising:

program code for generating a message identifying the link uniquely within the network region, and for sending the request message to an address-assigning node in the network region; and

program code for receiving a link number assignment message from the address-assigning node, the link number assignment message containing a region-wise unique link number generated by the address-assigning node for the link, and for assigning the link number from the received link number

assignment message to a link number field of the network-layer addresses of the nodes of the link.

32. A computer program product including a computer readable medium, the computer readable medium having an address configuration program stored thereon for execution in a computer functioning as an address-assigning node in a network region, the network region having a plurality of links each including a plurality of nodes, one of the nodes of each link serving as a specified router responsible for certain communications in the network region on behalf of the link, the address configuration program comprising:

program code for receiving messages from the specified routers of the links, each message identifying the associated link uniquely within the network region;

program code for assigning a region-wise unique link number to each link for which a request message has been received; and

program code for generating link number assignment messages and sending them to the specified routers, the link number assignment message sent to each specified router containing the link number assigned to the associated link.

33. A computer data signal including an address configuration program stored thereon for execution in a computer functioning as a specified router for a link in a network region, the address configuration program comprising:

(i) program code for receiving messages from specified routers of other links in the network region, the message from each specified router containing a number selected to be used as a region-wise unique link number for the associated link, and for storing the received numbers in association with the respective links in a local database;

(ii) program code for selecting a number to be used as a region-wise unique link number for the link, the selected number being a number not associated with another link in the local database; and

5 (iii) program code for generating a message containing the selected number and propagating the message within the network region for receipt by the other specified routers.

10 34. A computer data signal including an address configuration program for use in configuring nodes on a link in a network region with network-layer addresses, the address configuration program comprising:

15 program code for participating in assigning, for each node of the link, a link-wise unique node number to a first field of the network-layer address of the node;

program code for generating a request message identifying the associated link uniquely within the network region, and for propagating the request message within the network region; and

20 program code for receiving a link number assignment message from an address-assigning node in the network region, the link number assignment message containing a region-wise unique link number generated by the address-assigning node for the link, and for assigning the link number from the received link number assignment message to a second field of the
25 network-layer addresses of the nodes of the link.

30 35. A computer data signal including an address configuration program for execution in a computer functioning as an address-assigning node in a network region, the network region having a plurality of links each including a plurality of nodes, one of the nodes of each link serving as a specified router responsible for certain communications in the network region on behalf of the link, the address configuration program comprising:

program code for receiving messages from the specified routers of the links, each message identifying the associated link uniquely within the network region;

5 program code for assigning a region-wise unique link number to each link for which a request message has been received; and

10 program code for generating link number assignment messages and sending them to the specified routers, the link number assignment message sent to each specified router containing the link number assigned to the associated link.

15 36. In a network region having a plurality of links, each link including a plurality of nodes, one of the nodes of each link serving as a specified router responsible for certain communications in the network region on behalf of the link, a system for configuring the nodes with network-layer addresses, comprising:

20 for each node of each link, means for assigning a group-wise unique node number to a first field of the network-layer address of the node; and

at the specified router of each of the links:

25 (i) means for receiving messages from the specified routers of the other links, the message from each specified router containing a number selected to be used as a region-wise unique link number for the link, and storing the received numbers in association with the respective links in a local database;

30 (ii) means for selecting a number to be used as a region-wise unique link number for the link, the selected number being a number not associated with another link in the local database; and

(iii) means for generating a message containing the selected number and propagating the message within the network region for receipt by the other specified routers.

37. In a network region having a plurality of links, each link including a plurality of nodes, one of the nodes of each link serving as a specified router responsible for certain communications in the network region on behalf of the link, system for configuring the nodes with network-layer addresses, comprising:

for each node of each link, means for assigning a link-wise unique node number to a first field of the network-layer address of the node;

means, at the specified router for each of the links, for generating a request message identifying the associated link uniquely within the network region, and for propagating the request message within the network region;

means, at an address-assigning node in the network region, for (i) receiving the request messages from the specified routers of the links, (ii) assigning a region-wise unique link number to each link for which a request message has been received, (iii) generating link number assignment messages containing the assigned link numbers, and (iv) propagating the link number assignment messages to the specified routers; and

means, at the specified router of each link, for receiving one of the link number assignment messages propagated by the address-assigning node and for assigning the link number from the received link number assignment message to a second field of the network-layer addresses of the nodes of the link.